



DEVELOPMENT OF A MULTIPURPOSE ROPE CLIMBING ROBOT

A dissertation submitted to the
Department of Electrical Engineering, University of Moratuwa
in partial fulfillment of the requirements for the
degree of Master of Science

By
NANDUN DHARSHANA HEW APATHIRANA

Supervised by: Prof. Lanka Udawatta

Department of Electrical Engineering
University of Moratuwa
Sri Lanka

2010

94554



Abstract

Wheeled vehicles or robots can achieve high speed locomotion with a relatively lower control complexity compared to other forms such as legged, hopping, or slithering robots. However, wheeled vehicles have several limitations on rough and uneven surfaces. For instance, wheel robots are much speedier than legged counterpart, but wheeled rope climbing robots are supposed to have very smooth ropes. Moreover, wheels come into contact with all details of the terrain causing higher energy losses in friction. More specifically, this causes higher losses on soft contact surfaces like a slacked rope. "Development of a multipurpose rope climbing robot" research is mainly focusing on developing a rope climbing robot that can be applied in various practical situations. Objective of this research is to design a four legged rope climbing robot that smoothly and steadily moves on a rope. Different mechanisms such as wheeled robot, brachialion robot, crawling type robots and different kind of legged robots have been developed to achieve this target and they have their own advantages and disadvantages. The proposed robot is a four legged robot and each leg has two degrees of freedom. One degree of freedom to rotate the leg forward and backward and second degree of freedom is for grip the rope by each leg. This robot is always grip the rope very steadily and moves on rope very smoothly. These two characteristics are important to carry a weight with a robot and easily can maintain an overall stability of the robot. The robot is planned to work on various situations and the nature of the rope or characteristics such as size of the rope, whether the rope vertical or horizontal directional and whether the rope is having some obstacles like knots or bend at some points on the rope. The robot is planned to have, the design is simple as possible and overall cost is minimized for use the robot in practical situations. For rescue operations, military operations, scientific researches operate on danger areas for humans and specific rope climbing operations can be achieved by the proposed robot. Results show the effectiveness of the proposed methodology and the practical implementation.



Keywords: Rope climbing robot, Legged robot, Brachiation robot, Mobile robotic systems, Micro-robotics, Robot controllers, Crawling type robots